

Review on the Use of MATLAB for Digital Image Processing

Dr. SINDHU MADHURI G Prof. Shashikala H. K, Dr Jayanthi Kannan,

Faculty of Engineering and Technology, Jain (Deemed-to-be University), Ramnagar District, Karnataka – 562112

Email Id- g.sindhumadhuri@jainuniversity.ac.in, hk.shashikala@jainuniversity.ac.in, k.jayanthi@jainuniversity.ac.in

ABSTRACT: *The MATLAB software is widely used for numeric intensive computation in engineering and science circles. Several toolboxes, the DSP toolbox & others are used in areas of optimization, spline, control and estimation, and device recognition. The DSP toolbox includes several important functions for 2-dimensional signal processing: 2-D DFT's, convolution, correlation, and graphing. Separable and non-separable processing is defined conveniently in terms of matrices. Also, many topics in the field of image enhancement and restoration are defined in terms of matrices. The signal generator provides the ability to speed up numerical complex operations by an average of 20 to 50. This paper describes several methods for growing MATLAB with programmable DSPs and graphics processors that include the aforementioned capability for fast processing, fixed-point and binary representation and manipulation, and display of images. They can be used to write functions for MATLAB script for 2-D scanning, multi-resolution processing, etc. These functions can be further accelerated with additional toolbox functions that connect the two processors directly, an operation underway.*

KEYWORDS: *Arithmetic Operation, Image Enhancement, Logical Operations, Relation Operators, Stretching.*

INTRODUCTION

Human beings have developed very detailed visual skills: the author can recognize a face in an instant, distinguish colors, and very rapidly process a vast volume of visual details. The universe is in constant motion though, look long enough at something and it will change in some way. Even a large concrete object, such as a building or a mountain, can change its appearance depending on the time of day (day or night); the amount of sunlight (clear or cloudy), or various shadows that fall upon it [1], [2]The author can deal with single images: snapshots of a visual scene. Although image processing will address changing scenes, in this text the author will not discuss it. The image processing requires modifying the character of a photo to either 1. Improving its human perception pictorial details, or 2. Make it more suitable for the autonomous perception of the system. The author must deal with digital image processing, which involves using a device to alter the character of a digital image. It must be remembered that these two aspects reflect two different but equally important aspects of image processing [2]. A procedure that fulfills condition (i) A procedure that "looks better" an image — may be the very worst condition satisfaction procedure (ii) Humans like to be sharp, transparent, and accurate in their pictures.

MATLAB IMPLEMENTATION ON IMAGE PROCESSING

1. Image processing aspects:

1.1. Image Enhancement:

Manipulating an image in such a way that the effect is more suitable for a specific use. (Sharpening or deblurring of the out-of-focus image, highlighting edges, enhancing image contrast or brightening the image, eliminating noise). Enhancing the edges of an image to make it appear sharper, Figure 1 shows an example. Notice the "cleaner" appearance of the second image; it is a friendlier image. Sharpening edges is a critical component of printing: for an image to appear on the printed page "at its best;" some sharpening is normally performed.



Figure 1: Image Enhancement

1.2. Image Restoration:

This can be viewed as restoring the harm done by a known cause to the picture. (Removal of blur caused by angular movement, removal of optical distortions).

1.3. Image segmentation:

This means subdividing the image into components or isolating other parts of the image. (Finding lines, circles, or similar shapes in a picture, in an aerial photograph, identifying vehicles, trees, buildings, or roads .

2. MATLAB:

MATLAB is a high-level language and collaborative environment that helps you to perform computer-intensive tasks faster than standard programming languages such as C, C++, and Fortran. Matlab is a collaborative, graphical language built for quick numerical matrix calculations. The Image Processing Toolbox is a set of functions that expand MATLAB's numeric computing environment capabilities [4]. These functions, combined with the expressiveness of the MATLAB language, make it simple to write image processing operations in a lightweight, transparent way, providing an ideal software prototyping environment for image processing problems. [3]

Image-processing workstations of the mentioned design have many advantages over traditional workstations:

- They are fairly inexpensive
- They include high-performance DSP and graphics processors
- They are modular, reconfigurable and updatable
- Hardware and software are easily accessible and used by the investigator
- Memory limitations of PC Matlab and D.

3. Digital Image Types:

3.1.Binary:

Every single pixel is black or white. Since only two possible values are available for each pixel (0,1), the author needs just one bit per pixel. Figure 2 shows the binary image.

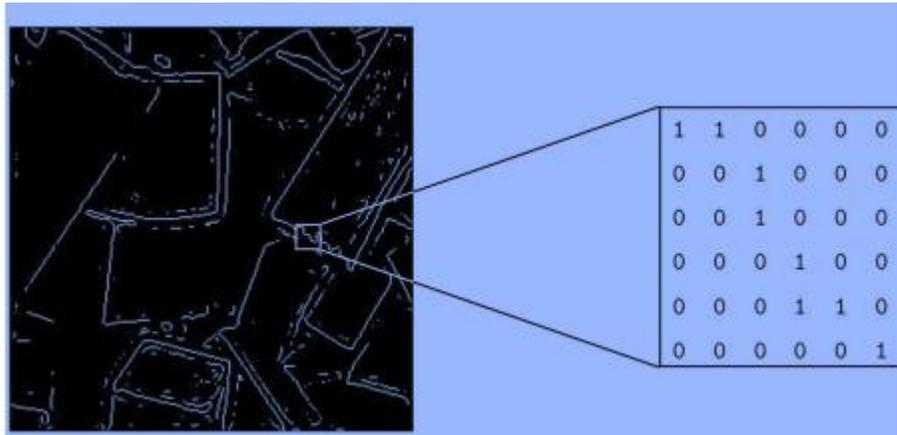


Figure 2: Binary Image



Figure 3: Gray Scale Image

3.2.Grayscale:

Every pixel is a gray shade, usually between 0 (black) and 255 (white). This range means that eight bits, or exactly one byte, can be used to represent every pixel. Many levels of greyscale are used but they are usually a power of 2. The grayscale is depicted in Figure 3.[4]

3.3.True Color, or RGB:

Each pixel has a particular color, that color is represented as red, green, and blue. If each of these components has a spectrum of 0–255, this gives a total of 256³ possible different colors. Such a picture is a three matrix "stack;" reflecting the values of red, green, and blue values. The RGB image is illustrated in Figure 4.

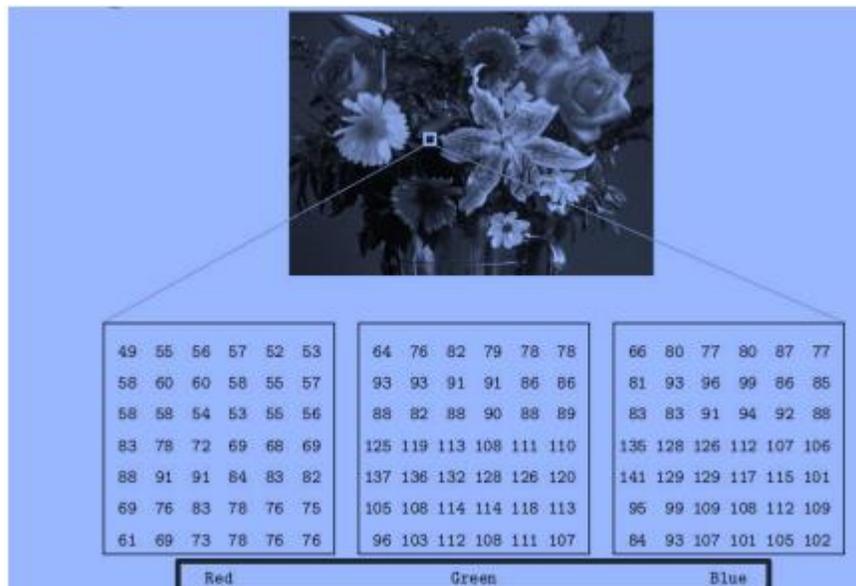


Figure 4: RGB Image

Some Matlab commands are shown below:

- *Image*: create and display image object
- *Imread*: read an image.
- *Figure*: creates a figure on the screen.
- *Imagesc*: image scale and display
- *Imshow*: image display
- *Colorbar*: colorbar display
- *Getimage*: get the data of images
- *Truesize*: adjust the image size
- *Zoom*: 2D images zoom in and out process
- *Pixval on*: turns on the pixel values in our figure.
- *Impixel(i,j)*: it will returns the value of the pixel (i,j)
- *Iminfo*: image information

4. Image Operation:

- RGB to Gray image conversion,
- Image Resize,
- Image Crop,
- Image Rotate,
- Image Histogram,
- Image Histogram equalization,
- Image DCT/IDCT, and
- Convolution

The histogram consists of the histogram of its gray levels given a grayscale image; that is, a graph showing the number of times each gray level appears in the image.[5][1] T. Wang, "MATLAB for Image Processing," 2010.

[2] H. Papasaika-Hanusch, "Digital Image Processing Using Matlab."

[3] A. R. Jalalvand, M. Mahmoudi, and H. C. Goicoechea, "Developing a novel paper-based enzymatic biosensor assisted by digital image processing and first-order multivariate calibration for rapid determination of nitrate in food samples," *RSC Adv.*, 2018, doi: 10.1039/C8RA02792G.

[4] Q. K. Kadhim, "Classification of Human Skin Diseases using Data Mining," *Int. J. Adv. Eng. Res. Sci.*, 2017, doi: 10.22161/ijaers.4.1.25.

[5] M. Khushi, G. Edwards, D. A. de Marcos, J. E. Carpenter, J. D. Graham, and C. L. Clarke, "Open source tools for management and archiving of digital microscopy data to allow integration with patient pathology and treatment information," *Diagn. Pathol.*, 2013, doi: 10.1186/1746-1596-8-22.

- The author can infer a great deal from his histogram about the appearance of a picture.
- The author's gray levels at the lower end would be clustered in a dark image
- The gray levels at the upper end would be clustered in a uniformly bright image.
- The author gray rates will be well spread out over most of the range in a well-contrasted picture.
- The poorly contrasted image, by spreading its histogram, the author would like to enhance its contrast.

5. Histogram Stretching (Contrast Stretching):

The poorly contrasted range picture [a, b]. The author can stretch the gray levels in the middle of the range by applying a piecewise linear function. This function has the effect of stretching the gray levels [a, b] to the gray levels [c, d] where $a < c$ and $d > b$ are all transformed according to the equation. The mat lab instruction is `adjust (I,[a, b],[c, d])`. Then, the pixel values less than c. This is shown in Figure 5.

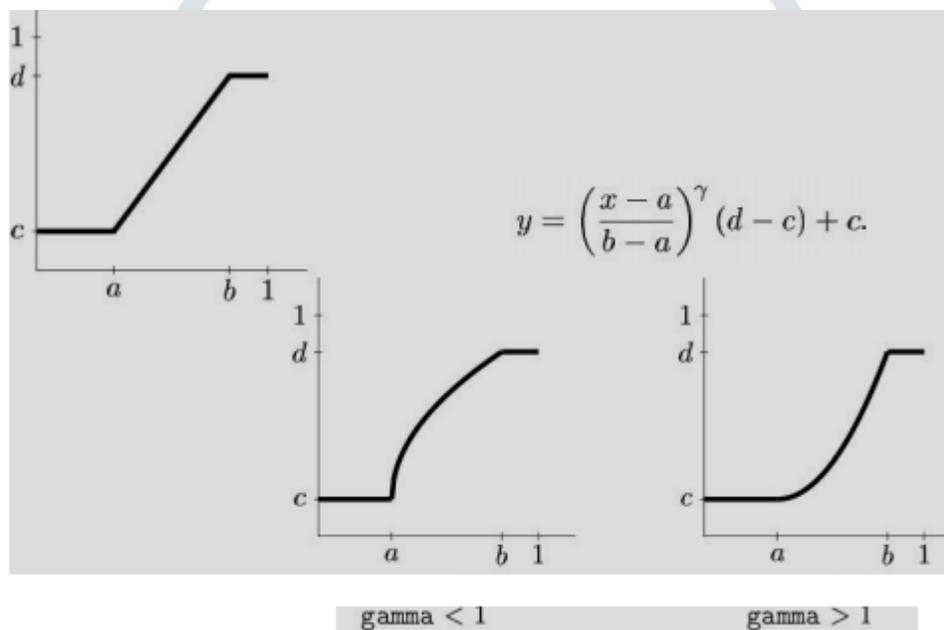


Figure 5: Histogram Stretching

Frequencies are the sum of distance by which grey values change. High-frequency components are characterized by major changes in gray values over small distances; (edges and noise). Low-frequency components are components characterized by minor changes in gray values. High pass filter: whether it "passes over" components of high frequency and reduces or removes components of low frequency. Low pass filter: whether it "passes" components of low frequency and lowers or removes components of high frequency. Noise is any image signal distortion, caused by external disruption.

5.1. Salt and pepper noise:

This is caused by sharp, unexpected image signal disturbances; white or black (or both) pixels are distributed randomly. It can be modeled by applying random values to an image.

5.2. Gaussian noise:

It is an idealized type of white noise, induced by random signal fluctuations.

5.3. Speckle noise:

Many radar systems pose a big problem. This can be modeled by multiplying random values by pixel values.

MATLAB operators are classified into three major categories:

- *Mathematical operators*: performing numerical calculations,
- *Relational operators*: quantitatively contrasting operands, and
- *Logical operators*: performing AND, OR, and NOT functions.

MATLAB has two distinct kinds of arithmetic operations. The rules of linear algebra are described by matrix arithmetic operations. Array arithmetic operations are performed by unit, and multidimensional arrays can be used. The character cycle (dot) distinguishes between array operations and matrix operations. For example, in the conventional sense, $A*B$ indicates matrix multiplication, while $A.*B$ indicates array multiplication, in the sense that the result is an array, the same size as A and B , in which each element is the product of the corresponding elements A and B . Since matrix and array operations are the same for addition and subtraction, the pairs of characters $+$ and $-$ are not used.

MATLAB makes a "warning" when coding a statement such as $B = A$ that B is identical to A , but does not explicitly move the information into B unless the details of A alter later in the process. This is a significant point since the use of various variables to "register" the same information can also increase the consistency and usability of code. Therefore, when writing MATLAB code, it is worth noting that MATLAB doesn't repeat information unless it is necessary. The arithmetic operators in MATLAB, where A and B are matrices or arrays and scalars are a and b . It can be simple or complex with all operands. If the operands are scalars the dot shown in the array operators is not necessary. Since images are 2-D arrays similar to matrices, all of the table operators apply to images.

CONCLUSION

The image processing essentially contains the following three steps: uploading the image employing image processing tools, analyzing and modifying the image, and performance in which the image or report centered on image analysis can be altered. There are two types of image processing methods used, namely analog and digital image processing. For hard copies such as printouts and images, analog image processing may be used. Image analysts use different analysis principles when using these visual techniques. Digital image processing methods aid by using computers to manipulate digital images. The author explained in this paper how MATLAB is implemented in the images. It has three operations: Arithmetical, logical, and relation operation. These operations are used for combining the images. It includes image addition, subtraction, multiplication, and division. It combines pixels of two images via AND OR operations. It performs bitwise OR operations on each pixel with a constant. It also includes an XOR operation. The author explained the aspects of image processing such as image enhancement, stretching, resizing, contrast enhancement etc.

REFERENCES

- [1] T. Wang, "MATLAB for Image Processing," 2010.
- [2] H. Papasaika-Hanusch, "Digital Image Processing Using Matlab."
- [3] A. R. Jalalvand, M. Mahmoudi, and H. C. Goicoechea, "Developing a novel paper-based enzymatic biosensor assisted by digital image processing and first-order multivariate calibration for rapid determination of nitrate in food samples," *RSC Adv.*, 2018, doi: 10.1039/C8RA02792G.
- [4] Q. K. Kadhim, "Classification of Human Skin Diseases using Data Mining," *Int. J. Adv. Eng. Res. Sci.*, 2017, doi: 10.22161/ijaers.4.1.25.
- [5] M. Khushi, G. Edwards, D. A. de Marcos, J. E. Carpenter, J. D. Graham, and C. L. Clarke, "Open source tools for management and archiving of digital microscopy data to allow integration with patient pathology and treatment information," *Diagn. Pathol.*, 2013, doi: 10.1186/1746-1596-8-22.